

Claims

1. A system for determining a guaranteed
productivity support agreement for a customer,
5 comprising:

at least one machine sensor adapted to
provide at least one machine sensor signal indicative
of the work performed by the machine;

at least one computer adapted to
10 receive the sensor signal,
calculate the productivity of the
machine, and

select a guaranteed productivity
customer support agreement in response to the
15 productivity.

2. The system of claim 1, wherein the
computer is adapted to determine whether the
productivity of the machine is deteriorating and
20 provide a productivity deterioration warning notice
signal in response to determining the productivity of
the machine is deteriorating.

3. A system for providing at least one
25 work machine to a customer, comprising:

at least one machine sensor adapted to
provide at least one machine sensor signal indicative
✓ of the operation performed by the machine, the payload
✓ handled by the machine and the amount of fuel consumed
30 by the machine; and

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a computer adapted to
receive the sensor signal,
calculate the productivity of the
machine,

5 select and generate a guaranteed
productivity customer support agreement in
response to the productivity of the machine,
monitor the productivity of the
machine,

10 determine whether the productivity of
the machine is deteriorating, and
provide a productivity deterioration
warning notice signal in response to determining
the productivity of the machine is deteriorating.

15 4. The system of claim 3, wherein the
machine sensor includes at least one operation sensor
adapted to provide at least one operating sensor
signal indicative of the operation performed by the
20 machine, at least one payload sensor adapted to
provide at least one payload sensor signal indicative
of the payload handled by the machine and at least one
fuel sensor adapted to provide at least one fuel
consumption sensor signal indicative of the amount of
25 fuel consumed by the machine.

5. The system of claim 4, including at
least one data storage device adapted to store on a
storage medium information including empirical data,
30 values representing the sensor signals and normalized

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operator productivity data for at least one work cycle
and wherein the computer is adapted to compare the
sensor signals to the empirical data to determine a
work cycle performed by the machine, determine a skill
✓ 5 level of the operator and provide a skill level notice
signal, the skill level of the operator being
determined by comparing the productivity of the
machine with the normalized operator productivity data
✓ 10 for the work cycle and calculate the change in the
productivity of the machine and skill level of the
operator, the data storage device being adapted to
store the change in the productivity of the machine
and skill level of the operator.

- 15 6. A system for providing at least one
work machine controlled by at least one operator to a
customer, comprising:
- at least one operation sensor adapted to
provide at least one operating sensor signal
20 ✓ indicative of the operation performed by the machine;
 at least one payload sensor adapted to
provide at least one payload sensor signal indicative
✓ of the payload handled by the machine;
 at least one fuel sensor adapted to provide
25 at least one fuel consumption sensor signal indicative
✓ of the amount of fuel consumed by the machine;
 at least one data storage device adapted to
store on a storage medium information including
empirical data, values representing the sensor
30 signals, normalized operator productivity data for at

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least one work cycle, normalized expected improvement
in skill level data for at least one work cycle and at
least one guaranteed productivity customer support
agreement having at least one minimum productivity
5 limit and corresponding price;

a computer including a CPU adapted to
receive the sensor signals,
compare the sensor signals to the
empirical data to determine a work cycle
10 performed by the machine,
✓ a) calculate the productivity of the
machine and provide a productivity notice signal,
the productivity being a function of an amount of
fuel consumed and at least one of a payload
15 handled by the machine and an operation performed
by the machine,

determine a skill level of the operator
and provide a skill level notice signal, the
skill level of the operator being determined by
20 comparing the productivity of the machine with
the normalized operator productivity data for the
work cycle,

select and generate the guaranteed
productivity customer support agreement
25 establishing at least one minimum productivity
limit and corresponding price in response to the
skill level,

44 monitor the machine,

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continuously calculate the productivity of the machine and determine the skill level of the operator,

✓
5 calculate the change in the productivity of the machine and skill level of the operator, the data storage device being adapted to store the change in the productivity of the machine and skill level of the operator,

10 determine whether the productivity of the machine is deteriorating as a function of at least one of the change in the productivity of the machine, the change in the skill level of the operator and the normalized expected improvement in skill level data,

15 provide a productivity deterioration warning notice signal in response to determining the productivity of the machine is deteriorating,

20 provide a service notice signal in response to the step of determining whether the productivity of the machine is deteriorating,

provide an agreement warning notice signal in response to the step of determining whether the productivity of the machine is deteriorating and considering the limit,

25 generate at least one message record, the message record including at least one of the signals and notice signals, and

30 the data storage device being adapted to store values representing the message record; and

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at least one communication device adapted to receive the message record and provide the message record to at least one of the operator, a service organization, the customer and an owner of the
5 machine.

7. A method of determining a guaranteed customer support agreement for a customer, the method comprising the steps of:
10 ✓ determining the productivity of the machine;
and
generating a guaranteed productivity customer support agreement establishing at least one minimum productivity limit.

15 8. The method of claim 7, wherein an operator operates the machine and including the step of determining a skill level of the operator.

20 9. The method of claim 8, including the steps of determining whether the productivity of the machine is deteriorating and communicating a productivity deterioration warning notice to at least one of the operator, a service organization, the
25 customer and an owner of the machine.

10. A method of providing at least one work machine to a customer, the method comprising the steps of:

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✓ determining the productivity of the machine,
the productivity being at least a function of a time
period, a fuel consumed and at least one of a payload
handled by the machine and an operation performed by
5 the machine;

✓ determining a skill level of the operator;
generating a guaranteed productivity
customer support agreement establishing at least one
minimum productivity limit and corresponding price in
10 response to the skill level;

determining whether the productivity of the
machine is deteriorating; and

communicating a productivity deterioration
warning notice to at least one of the operator, a
15 service organization, the customer and an owner of the
machine.

11. The method of claim 10, including the
steps of monitoring the operation of the machine and
20 determining a work cycle performed by the machine.

12. The method of claim 11, wherein the
machine is operated by an operator and including the
steps of comparing the productivity of the machine
25 with normalized operator productivity data for the
work cycle and determining a skill level of the
operator in response to the step of comparing the
productivity of the machine with the productivity
data.

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13. The method of claim 12, including the steps of performing comparisons of the productivity of the machine with the productivity data and determining the change in the skill level of the operator in response to the step of performing subsequent comparisons of the productivity of the machine with the productivity data.

14. The method of claim 13, including the step of providing an incentive to the operator for at least achieving a predetermined change in skill level, such predetermined change in skill level being determined by considering a normalized expected improvement in skill level, and the incentive being at least one of a reward, penalty, compensation, and failure to impose at least one of a reward, penalty and compensation.

15. The method of claim 13, including the steps of determining a productivity deterioration warning notice in response to performing subsequent comparisons of the productivity of the machine with the productivity data and considering the normalized expected improvement in skill level, determining a service notice in response to the step of determining whether the productivity of the machine is deteriorating and determining an agreement warning in response to the step of determining whether the productivity of the machine is deteriorating and considering the limit.

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16. The method of claim 15, including the step of generating at least one message record and including in the message record a signal indicative of at least one of the productivity, skill level, service notice, agreement warning, productivity deterioration warning notice, time period, fuel consumed, payload handled by the machine and the operation performed by the work machine.

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17. A method of providing at least one work machine controlled by at least one operator to a customer, the method comprising the steps of:

✓ monitoring the operation of the machine;
15 determining a work cycle performed by the machine;

determining the productivity of the machine, the productivity being at least a function of a time period, a fuel consumed and at least one of a payload handled by the machine and an operation performed by the machine;

20 comparing the productivity of the machine with normalized operator productivity data for the work cycle;

25 determining a skill level of the operator in response to the step of comparing the productivity of the machine with the productivity data;

generating a guaranteed productivity customer support agreement establishing at least one

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minimum productivity limit and corresponding price in
response to the skill level;

monitoring the machine;

performing subsequent comparisons of the
5 productivity of the machine with the productivity
data;

determining the change in the skill level of
the operator in response to the step of performing
subsequent comparisons of the productivity of the
10 machine with the productivity data;

providing an incentive to the operator for
at least achieving a predetermined change in skill
level, such predetermined change in skill level being
determined by considering a normalized expected
15 improvement in skill level, and the incentive being at
least one of a reward, penalty, compensation, and
failure to impose at least one of a reward, penalty
and compensation;

determining whether the productivity of the
20 machine is deteriorating and determining a
productivity deterioration warning notice in response
to performing subsequent comparisons of the
productivity of the machine with the productivity data
and considering the normalized expected improvement in
25 skill level;

determining a service notice in response to
the step of determining whether the productivity of
the machine is deteriorating;

determining an agreement warning in response
30 to the step of determining whether the productivity of

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the machine is deteriorating and considering the limit;

- generating at least one message record;
 - including in the message record a signal
- 5 indicative of at least one of the productivity, skill level, service notice, agreement warning, productivity deterioration warning notice, time period, fuel consumed, payload handled by the machine and the operation performed by the work machine; and
- 10 communicating the message record to at least one of the operator, a service organization, the customer and an owner of the machine.

18. A work machine adapted to be controlled
15 by an operator and for acting upon a load through a plurality of work cycles, comprising:

- a frame;
- a plurality of ground engaging devices supporting the frame;
- 20 an operator compartment supported by the ground engaging devices;
- an implement having a linkage for operably connecting the implement to the frame;
- an engine operably coupled to the ground
- 25 engaging devices; and
- a system for determining a guaranteed productivity support agreement for a customer, including:

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at least one machine sensor adapted to
provide at least one machine sensor signal indicative
of the work performed by the machine;

5 at least one computer adapted to
 receive the sensor signal,
 calculate the productivity of the
 machine, and
 select a guaranteed productivity
 customer support agreement in response to the
10 productivity.

19. The work machine of claim 18, wherein
the computer is adapted to determine whether the
productivity of the machine is deteriorating and
15 provide a productivity deterioration warning notice
 signal in response to determining the productivity of
the machine is deteriorating.

20. A work machine adapted to be controlled
20 by an operator and for acting upon a load through a
 plurality of work cycles, comprising:
 a frame;
 a plurality of ground engaging devices
 supporting the frame;
25 an operator compartment supported by the
 ground engaging devices;
 an implement having a linkage for operably
 connecting the implement to the frame;
 an engine operably coupled to the ground
30 engaging devices; and

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a system for measuring operator productivity of at least one work machine for a customer, including:

5 at least one machine sensor adapted to
provide at least one machine sensor signal
indicative of the operation performed by the
machine, the payload handled by the machine and
the amount of fuel consumed by the machine;
10 at least one data storage device
adapted to store information on a storage medium;
a computer adapted to
receive the sensor signals,
calculate the productivity of the
machine, the productivity being a function
15 of an amount of fuel consumed and at least
one of a payload handled by the machine and
an operation performed by the machine,
calculate the change in the
productivity of the machine, the data
20 storage device being adapted to store the
change in the productivity of the machine;
and
determine whether the productivity of
the machine is deteriorating.

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21. A system for measuring operator productivity of at least one work machine for a customer, comprising:

30 at least one machine sensor adapted to
provide at least one machine sensor signal indicative

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of the operation performed by the machine, the payload handled by the machine and the amount of fuel consumed by the machine; and

5 a computer including a CPU adapted to
 receive the sensor signals and
 calculate the productivity of the
machine, the productivity being a function of an
amount of fuel consumed and at least one of a
payload handled by the machine and an operation
10 performed by the machine.

22. The system of claim 21, wherein the
computer is adapted to calculate the change in the
productivity of the machine.

15 23. A system for measuring operator
productivity of at least one work machine for a
customer, comprising:

 at least one machine sensor adapted to
20 provide at least one machine sensor signal indicative
of the operation performed by the machine, the payload
handled by the machine and the amount of fuel consumed
by the machine;

 at least one data storage device adapted to
25 store information on a storage medium;

 a computer adapted to
 receive the sensor signals,
 calculate the productivity of the
machine, the productivity being a function of an
30 amount of fuel consumed and at least one of a

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payload handled by the machine and an operation performed by the machine,

calculate the change in the productivity of the machine, the data storage device being adapted to store the change in the productivity of the machine; and

determine whether the productivity of the machine is deteriorating.

24. The system of claim 23, wherein the machine sensor includes at least one operation sensor adapted to provide at least one operating sensor signal indicative of the operation performed by the machine, at least one payload sensor adapted to provide at least one payload sensor signal indicative of the payload handled by the machine and at least one fuel sensor adapted to provide at least one fuel consumption sensor signal indicative of the amount of fuel consumed by the machine.

25. The system of claim 24, wherein the information includes empirical data, values representing the sensor signals, normalized operator productivity data for at least one work cycle and the computer is adapted to compare the sensor signals to the empirical data to determine a work cycle performed by the machine, determine a skill level of the operator and provide a skill level notice signal, the skill level of the operator being determined by comparing the productivity of the machine with the

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normalized operator productivity data for the work
cycle, calculate the change in the skill level of the
operator and determine whether the productivity of the
machine is deteriorating as a function of at least one
5 of the change in the productivity of the machine, the
change in the skill level of the operator and the
normalized expected improvement in skill level.

26. The system of claim 25, wherein the
10 computer is adapted to provide a productivity
deterioration warning notice signal in response to
determining the productivity of the machine is
deteriorating and generate at least one message record
including the notice signal, the data storage device
15 is adapted to store values representing the message
record and at least one communication device is
adapted to receive the message record and provide the
message record to at least one of the operator, a
service organization, the customer and an owner of the
20 machine.

27. A method of providing incentives to an
operator of a work machine, the method comprising the
steps of:
25 determining a work cycle performed by the
machine;
determining the productivity of the machine;
comparing the productivity of the machine
with normalized operator productivity data for the
30 work cycle;

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determining a skill level of the operator in response to the step of comparing the productivity of the machine with the productivity data;

5 determining the change in the skill level of the operator in response to comparing the productivity of the machine with the productivity data; and

providing an incentive to the operator for at least achieving a predetermined change in skill level.

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28. The method of claim 27, including the steps of generating at least one message record including a signal indicative of the skill level and communicating the message record to at least one of
15 the operator, a service organization, a customer and an owner of the machine

29. A method of providing incentives to an operator of a work machine, the method comprising the
20 steps of:

determining a work cycle performed by the machine;

determining the productivity of the machine, the productivity being at least a function of a time
25 period, a fuel consumed and at least one of a payload handled by the machine and an operation performed by the machine;

comparing the productivity of the machine with normalized operator productivity data for the
30 work cycle;

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determining a skill level of the operator in response to the step of comparing the productivity of the machine with the productivity data;

5 determining the change in the skill level of the operator in response to comparing the productivity of the machine with the productivity data;

10 providing an incentive to the operator for at least achieving a predetermined change in skill level, such predetermined change in skill level being determined by considering a normalized expected improvement in skill level, and the incentive being at least one of a reward, penalty, compensation, and failure to impose at least one of a reward, penalty and compensation;

15 determining whether the productivity of the machine is deteriorating and determining a productivity deterioration warning notice in response to performing subsequent comparisons of the productivity of the machine with the productivity data and considering the normalized expected improvement in skill level;

20 generating at least one message record including a signal indicative of the skill level; and communicating the message record to at least one of the operator, a service organization, a customer and an owner of the machine.

30. A system for determining when a work machine needs service, comprising:

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at least one machine sensor adapted to provide at least one machine sensor signal indicative of the operation performed by the machine, the payload handled by the machine and the amount of fuel consumed by the machine; and

a computer adapted to receive the sensor signals, calculate the productivity of the machine, determine a skill level of the operator, calculate the change in the productivity of the machine and skill level of the operator, determine whether the productivity of the machine is deteriorating and provide a service notice signal in response to the step of determining whether the productivity of the machine is deteriorating.

31. The system of claim 30, wherein whether the productivity of the machine is deteriorating is determined as a function of at least one of the change in the productivity of the machine, the change in the skill level of the operator and the normalized expected improvement in skill level data.

32. The system of claim 30, wherein the computer is adapted to generate at least one message record, the message record including the service notice signal and including at least one communication device adapted to receive the message record and provide the message record to at least one of the operator, a service organization, the customer and an owner of the machine.

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33. A system for determining when a work machine needs service, comprising:

5 at least one machine sensor adapted to provide at least one machine sensor signal indicative of the operation performed by the machine, the payload handled by the machine and the amount of fuel consumed by the machine; and

10 at least one data storage device adapted to store on a storage medium information including normalized operator productivity data for at least one work cycle and normalized expected improvement in skill level data;

15 a computer adapted to receive the sensor signals, calculate the productivity of the machine,

20 determine a skill level of the operator, the skill level of the operator being determined by comparing the productivity of the machine with the normalized operator productivity data for the work cycle,

25 calculate the change in the productivity of the machine and skill level of the operator,

determine whether the productivity of the machine is deteriorating as a function of at least one of the change in the productivity of the machine, the change in the skill level of the

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operator and the normalized expected improvement
in skill level data,

5 provide a service notice signal in
 response to the step of determining whether the
 productivity of the machine is deteriorating,
 generate at least one message record,
 the message record including the
 service notice signal; and

10 at least one communication device adapted to
 receive the message record and provide the message
 record to at least one of the operator, a service
 organization, the customer and an owner of the
 machine.

15 34. The system of claim 33, wherein the
 productivity is a function of an amount of fuel
 consumed and at least one of a payload handled by the
 machine and an operation performed by the machine.

20 35. A work machine adapted to be controlled
 by an operator and for acting upon a load through a
 plurality of work cycles, comprising:

 a frame;
 a plurality of ground engaging devices
25 supporting the frame;
 an operator compartment supported by the
 ground engaging devices;
 an implement having a linkage for operably
 connecting the implement to the frame;

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an engine operably coupled to the ground
engaging devices; and

a system for determining fees to be paid by
a customer that are based on machine productivity,
5 including:

at least one machine sensor adapted to
provide at least one machine sensor signal indicative
of the operation performed by the machine, the payload
handled by the machine and the amount of fuel consumed
10 by the machine; and

a computer adapted to receive the sensor
signals, calculate the productivity of the machine,
determine a skill level of an operator of the machine,
the skill level of the operator being determined by
15 comparing the productivity of the machine with the
normalized operator productivity data for the work
cycle, and select an agreement establishing a price in
response to the skill level.

20 36. The work machine of claim 35, wherein
the productivity is a function of an amount of fuel
consumed and at least one of a payload handled by the
machine and an operation performed by the machine.

25 37. The work machine of claim 35, wherein
the agreement establishes at least one minimum
productivity limit and corresponding price.

30 38. The work machine of claim 35, including
at least one communication device adapted to receive

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the price and provide the price to at least one of the operator, a service organization, the customer and an owner of the machine.

- 5 39. A work machine adapted to be controlled by an operator and for acting upon a load through a plurality of work cycles, comprising:
- a frame;
 - a plurality of ground engaging devices
 - 10 supporting the frame;
 - an operator compartment supported by the ground engaging devices;
 - an implement having a linkage for operably connecting the implement to the frame;
 - 15 an engine operably coupled to the ground engaging devices; and
 - a system for determining when a work machine needs service, including:
 - at least one machine sensor adapted to
 - 20 provide at least one machine sensor signal indicative of the operation performed by the machine, the payload handled by the machine and the amount of fuel consumed by the machine; and
 - a computer adapted to receive the sensor
 - 25 signals, calculate the productivity of the machine, determine a skill level of the operator, calculate the change in the productivity of the machine and skill level of the operator, determine whether the productivity of the machine is deteriorating and
 - 30 provide a service notice signal in response to the

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step of determining whether the productivity of the machine is deteriorating.

40. The work machine of claim 39, wherein
5 whether the productivity of the machine is
deteriorating is determined as a function of at least
one of the change in the productivity of the machine,
the change in the skill level of the operator and the
normalized expected improvement in skill level data.

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41. The work machine of claim 39, wherein
the computer is adapted to generate at least one
message record, the message record including the
service notice signal and including at least one
15 communication device adapted to receive the message
record and provide the message record to at least one
of the operator, a service organization, the customer
and an owner of the machine.

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42. A system for determining fees to be
paid by a customer that are based on machine
productivity, comprising:

at least one machine sensor adapted to
provide at least one machine sensor signal indicative
25 of the operation performed by the machine, the payload
handled by the machine and the amount of fuel consumed
by the machine; and

a computer adapted to receive the sensor
signals, calculate the productivity of the machine,
30 determine a skill level of an operator of the machine,

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the skill level of the operator being determined by comparing the productivity of the machine with the normalized operator productivity data for the work cycle, and select an agreement establishing a price in
5 response to the skill level.

43. The system of claim 42, wherein the productivity is a function of an amount of fuel consumed and at least one of a payload handled by the
10 machine and an operation performed by the machine.

44. The system of claim 42, wherein the agreement establishes at least one minimum productivity limit and corresponding price.
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45. The system of claim 42, including at least one communication device adapted to receive the price and provide the price to at least one of the operator, a service organization, the customer and an
20 owner of the machine.

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